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Summary

The pattern of fish kills in 1993 showed a dramatic change from that of the previous ten years. The number of incidents showed a very welcome reduction to a total of 33, the lowest since systematic records began to be kept in 1982. Only one case of damage caused by silage effluent was reported and two from farm effluents - in the recent past these were the most frequent and serious sources.

However, fish kills provisionally attributed to 'enrichment' attained a record total of 16, most of them in the lakes in Co. Cavan in the Erne catchment. Sewage and runoff from agricultural land are the main sources of the phosphorous which brings about excessive blooms of microscopic algae.

Enrichment has caused extremely serious problems in the past, in particular in Loughs Ennel and Sheelin. In both cases, remedial measures were successful, although problems have arisen again in the case of Lough Sheelin. The more widespread problem in the Erne catchment may be more difficult to contain and there are also signs of trouble in the Rivers Shannon and Lee.

The trend of increasing numbers of enrichment-based fish kills does not necessarily mean that even more such incidents will take place in 1994 - but it is virtually certain that similar problems to those of 1993 will arise sooner or later unless action is taken.

Major incidents

Tens of thousands of perch and roach died in July in a number of lakes in the Erne catchment in Counties Cavan and Longford. Very large numbers of perch, together with gudgeon and minnow died in Lough Derg near Terryglass on 12th July. The following day dead perch fry were observed over a wide area of the lake from Terryglass to Dromineer. The first incident in the Erne catchment was recorded on 15 July and the problem continued throughout the rest of the month and into August. These were the only major incidents in 1993. In rivers elsewhere, the maximum numbers of fish killed were in the order of 500 in four rivers in the south. Details are given in Table 1.

Distribution and dates

The established pattern of fish kills was broken. Only one incident was reported in each of the Eastern and Southern Regions and five in Shannon. These three regions had accounted for 70% of the total for the previous ten years. A total of 6 kills were recorded from January to May and 3 in June which had been the worst month previously. The trend for improvement changed abruptly in mid July when fish began to die in Lough Derg and the first of 14 distinct, but connected, incidents was reported from Dereskit Lough near Killeshandra, one of the many valuable coarse fish lakes in the Erne catchment. Although no new incidents were reported in August, fish continued to die in some of the Erne lakes. There were three kills in September and one in October.

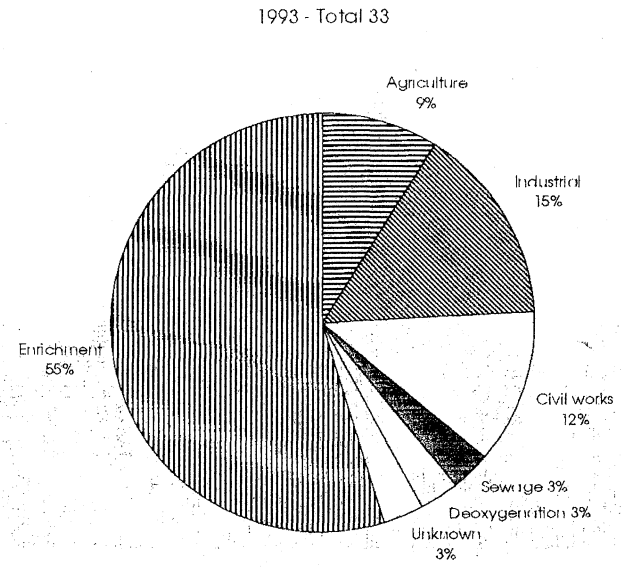
For the fish kills which took place in rivers, the total length of stream affected was 19 km, an average of 1.5 km per incident. In each of the four previous years the total had been over 100 km and the lowest average 1.6 km.

Causes

Only one case of damage caused by silage effluent and two from farmyard waste were reported. Factory effluents were implicated five times and a spillage of cement once. Problems arose from one sewage treatment works, from two waterworks and one swimming pool. This very considerable improvement was offset to some extent by a new, but long-expected, problem of fish killed in lakes with enriched water (Figure 1).

The improvement in the farmyard and silage effluent discharges, which had been the most serious source of damage in the 1980s, resulted in part from the continual upgrading of farm facilities and in part from the change to the use of baled silage. The packing of silage in polythene bags has replaced the use of pits in which the 'liquor' accumulated and could overflow into rivers. The baled system in any case protects the silage from rain so that little run-off takes place. In addition, the bales are widely distributed over fields so that any spillage that does occur can be absorbed in the soil rather than running off directly to a stream. The only problem lies in the disposal of the polythene.

Figure 1. Principal causes of fish kills in 1993. 'Enrichment' is considered the most likely cause of incidents not yet fully explained.

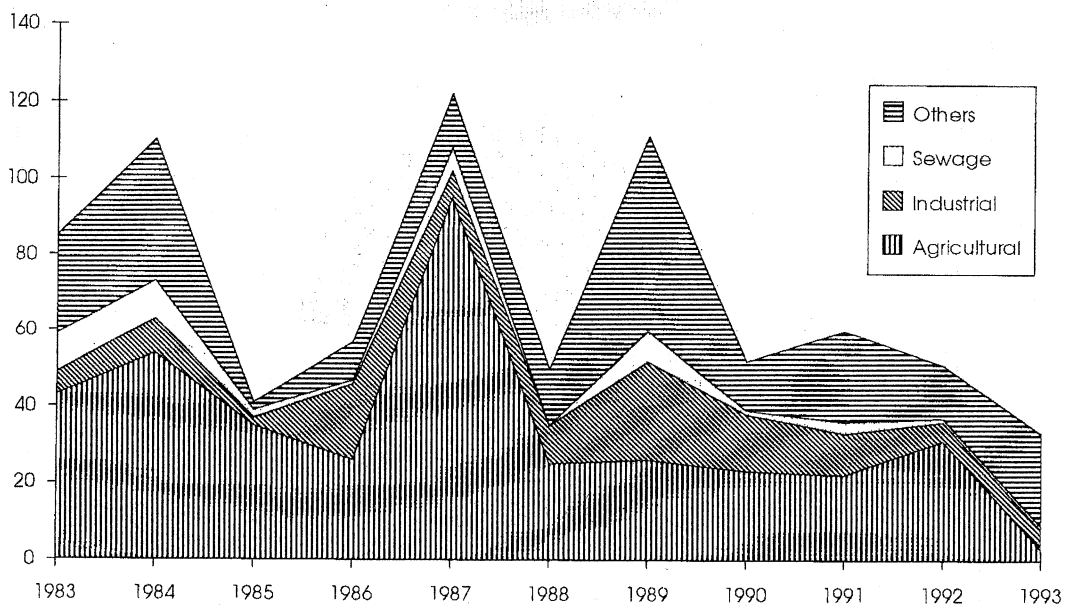


Industrial and 'civil works' incidents are sporadic and can usually be attributed to accidental spillages. The numbers of these have not varied significantly over the years and they arise largely because of carelessness in handling materials or in routine maintenance work. Many supervisors of swimming pools are unaware that their clear water contains enough chlorine to poison any fish that live downstream of the point where they empty the pool. Similarly, sludge from water treatment plants is sometimes not recognised as organic material with an enormous appetite for oxygen.

Sewage treatment plants are being upgraded throughout the country so that this cause may disappear in time - there have been some years in the recent past when no sewage-based fish kills were reported. Arrangements for containing spillages are increasingly being required in factories situated close to open water so that damage from these accidents may also become fewer. There may be cause to hope that the days when our rivers were seen as convenient dumps for all sorts of waste are coming to an end.

The reduction in numbers of fish kills in 1993 was almost certainly helped by the fact that the rainfall - and hence river flows and dilution of effluents - in May and June was well above average. However, the downward trend shown in Figure 2 has begun to look as if it reflects a real positive development in the fight against pollution.

Figure 2. Trends in causes of fish kills 1983-1992. 'Others' in 1993 is explained largely by enrichment.

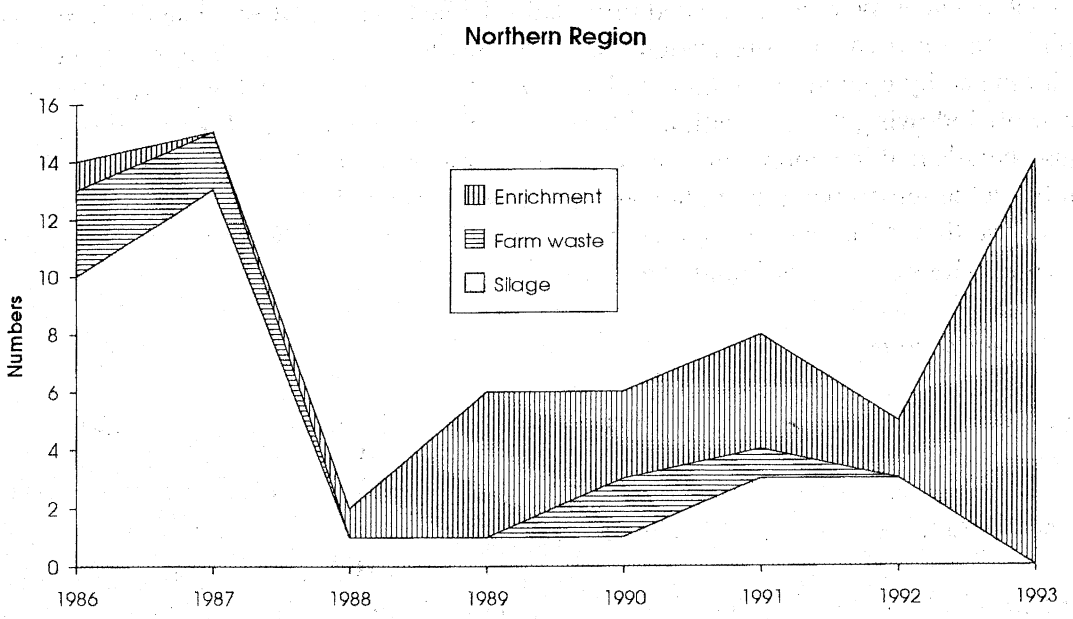


Enrichment

There remains the new feature of 16 fish kills being provisionally attributed to 'enrichment'. Fourteen of these took place in the lakes of the Northern Region in the Erne catchment, most of them in Counties Cavan, Longford and Monaghan (Figure 3). Enrichment was also implicated in a major fish kill in Lough Derg near Terryglass, Co. Offaly. The problem in Loughnaglack near Carrickmacross appears to come mainly from inadequately treated sewage. These incidents are associated with algal blooms resulting from excessive phosphorous in the water. There is no simple proof of cause and effect but the circumstantial evidence is very strong in the absence of any other recognisable factor.

From time to time fish kills in lakes are attributed to disease or to infestation from a parasite. The present series of annual fish-kill reports attempts to confine itself to pollution-based incidents and to omit cases of mortality from other causes. The distinction cannot always be made with certainty and a general rule adopted is to blame pollution when fish belonging to a range of unrelated species die. For example, if dead bream and roach are found but no perch or pike, disease could well be implicated because bream and roach are quite closely related and likely to be susceptible to the same pathogens. But, when pike or perch are killed together with roach and bream, pollution is more likely to be the direct cause. The four represent three different families of fish, each with a very distinct life style and the chances that they would all succumb to the same fatal disease are very low.

Figure 3. Fish kills attributed to agricultural effluents and to enrichment in the Northern Region.



In the case of the Erne lakes in 1993, perch and roach were found together in most incidents. In the few cases where only one of the two species was found, the general pattern of events was so similar that it was considered reasonable to ascribe the problem to 'enrichment', which causes excessive blooms of algae. The usual assumption in these cases is that death is caused by low levels of oxygen occurring in the hours of darkness when, in the absence of photosynthesis, the algae are taking up rather than releasing oxygen. However, oxygen levels measured in daylight were relatively high and the fact that dying fish were observed, even when there was no sign of oxygen depletion, suggests that other factors were involved.

The deaths of tens of thousands of fish in these lakes is a very serious matter. Local damage to the stocks is only part of the problem, since each breeding pair of perch, roach and bream produces thousands of offspring. Therefore, the stocks in the part of the lake in which the fish died will probably be replenished quickly by migration from elsewhere in the lake system. The disturbing factor is the observation that phosphorous levels in these lakes have been increasing for many years. Depending on the weather in any given summer, this may or may not result in an algal bloom. At this stage it is not possible to predict the next such occurrence.

While the entire fish stock may not be at risk, the occurrence of last year's kills must have had an extremely serious effect on the morale of visiting anglers. It is not possible to reassure the tourist interests at this stage. Furthermore, fish kills are an important early indicator of deterioration of water quality which, if unchecked, can lead to problems for industry and to greatly increased costs in treatment of water for domestic, industrial and agricultural use.

Dealing with effluents from 'point sources', from silage pits, farmsteads and factories is relatively easy, if expensive, and the continuing downward trend has shown that the problem can almost be eliminated provided sufficient care is taken. The threat from phosphorous is much more difficult to avert. Sewage-based phosphorous can be eliminated by upgrading treatment plants. The phosphorous which is derived from run-off following the application of fertiliser is harder to locate and remedial action also entails making approaches to very large numbers of farmers. In this connection, it has to be remembered that phosphorous which is carried off the land in surface water so that it enters rivers and lakes is money wasted from the point of view of the farmer who has paid for it and cannot expect any return.

Previous reports

Reports are published in the Department of the Marine's *Fishery Leaflet* series. Previous issues are:

Edward Fahy: Leaflet 128 for 1983 and 1984; Leaflet 132 for 1985.

Desmond McCarthy: Leaflet 141 for 1986 and 1987 with summary for 1969-1987.

Desmond McCarthy and Christopher Moriarty: Leaflet 143 for 1988.

Christopher Moriarty: Leaflets 143, 146 and 149 and 157 for 1989 to 1992.

Table 1. Summary of 33 fish kills reported in 1993. Estimates of numbers in lakes are indicated by: *** more than 10,000; ** between 1,000 and 10,000; * less than 1,000. Exact values where given indicate number of dead fish visible and are usually underestimates. 'Enrichment', where stated, is taken to be the most likely cause of mortality.

	River/Lake	Location	Stream length (m)	Numbers	Species	Cause
Eastern Region						
13 May	Loughnaglack	Carrickmacross H8502	lake	16	Pike,perch,bream,roach	Enrichment
Southern Region						
9 Jun	Coolcullen	Ridge S6167	1500	500	Trout	Farm effluent
Southwestern Region						
2 Jan	Glanshearoon	Crag R0111	3000	500	Trout	Unknown
26 Feb	Mall	Dingle Q4501	600	500	Trout, eel, flounder	Cement spillage
18 Apr	Twopot	Bishopstown W6369	3000	100	Eel	Industrial
1 Sep	Kealarooth	Kilronane W2349	2000	300	Trout, salmon	Farm effluent
2 Sep	Brewery	Dunmanway W2352	100	20	Trout, salmon, loach	Swimming pool
10 Oct	Ballincollig	Ballincollig W5772	2000	400	Trout	Oil dispersant
Shannon Region						
23 Jun	L Derg	Dromineer R8581	lake	*	Perch fry	Enrichment
2 Jul	Feale	Listowel Q9833	1000	100	Sea trout	Industrial
12 Jul	L Derg	Terryglass N8601	lake	***	Perch,gudgeon,minnow	Enrichment
13 Jul	L Derg	Dromineer R8581	lake	**	Perch fry	Enrichment
24 Aug	Daar	Daar Bridge R2735	1000	500	Trout	Industrial
Western Region						
4 Jul	Carrowkilleen	Cloondayer M2072	200	20	Trout	Deoxygenation
Northwestern Region						
13 Mar	Glore	Treankeel M3592	500	100	Trout, salmon	Waterworks
9 Jun	Doonflin	Aughris Head G513	3000	100	Trout	Silage effluent
3 Sep	Deel	Crossmolina G1417	2	100	Salmon,minnow,crayfish	Sewage
Northern Region						
22 Feb	Convent Lake	Monaghan H6233	lake	***	Bream, perch	Chemical spillage
16 May	Big Burn	Cranford C1831	3000	100	Trout, eel	Waterworks
15 Jul	Derreskit L	Killeshandra H2806	lake		Roach	Enrichment
15 Jul	Bunerky Lake	Bawnboy H1718	lake	**	Perch, roach	Enrichment
23 Jul	L Gowna	Loch Gowna N2689	lake	***	Perch, roach	Enrichment
23 Jul	L Oughter	Killykeen H3504	lake	***	Perch, roach	Enrichment
24 Jul	Brackley	Bawnboy H1820	lake	***	Perch, roach	Enrichment
26 Jul	Ardan Lake	Butlers Bridge H3612	lake	**	Perch, roach	Enrichment
26 Jul	Bawn Lake	Killeshandra H2930	lake	***	Perch, roach	Enrichment
27 Jul	L Garadice	Ballinamore H1711	lake	**	Perch, roach, bream,	Enrichment
27 Jul	Town Lake	Killeshandra H3008	lake	*	Roach	Enrichment
28 Jul	Lakefield L	Bawnboy H1918	lake	*	Roach, perch	Enrichment
30 Jul	Annagh Lake	Butler's Bridge H3912	lake	**	Perch	Enrichment
30 Jul	Lower Lake	Arvagh N2895	lake	**	Perch	Enrichment
31 Jul	Beaghy Lake	Cavan, H4405	lake	**	Perch, roach	Enrichment
31 Jul	Glasshouse	Killeshandra H2606	lake	**	Roach	Enrichment

Table 2. Total length of stream (in kilometres) and number of incidents (n).

Region	*1989*		*1990*		*1991*		*1992*		*1993*		*1989-1992*		
	km	*n*	*km*	*n*	*km*	*n*	*km*	*n*	*km*	*n*	*km*	*n*	*mean*
Eastern	54	24	57	13	16	6	56	7			183	50	3.7
Southern	33	20	33	15	28	19	65	16	2	1	160	71	2.2
Southwestern	14	23	6	4	1	5	5	3	11	6	37	41	0.9
Shannon	55	17	10	6	22	14	14	13	1	1	102	51	2.0
Western	3	3	1	2	11	4	8	3	1	1	24	13	1.9
Northwestern	5	4	6	2			1	1	4	3	16	10	1.6
Northern	5	4	9	3	5	4	15	5	3	1	37	16	2.3
Total	168	95	122	45	83	52	164	48	22	13	559	252	2.2
Annual mean	1.8		2.7		1.6		3.4		1.7		2.2		

Table 3. Numbers of fish kills recorded from 1983 to 1993.

	1983	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991*	*1992*	*1993*	*Total*
January		1			1			1			1	4
February		2	1		2	1					2	8
March		4	1	1		3	1	2		1	1	14
April	1	4	2	1	1	6	3	3	1		1	23
May	2	10	3	1	16	9	15	10	13	5	2	86
June	23	34	23	36	51	19	34	12	13	18	3	266
July	38	31	6	17	31	1	48	10	10	22	18	232
August	15	12	1	3	18	6	9	7	16	1	1	89
September	3	8	1	1	2	3		6	5	2	3	34
October		3	1	6		1	1				1	13
November	2	1	1			1	1		1			7
December	1		1					1	1	2		6
	85	110	41	66	122	50	112	52	60	51	33	782

Table 4. Regional distribution of fish kills

	1983	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991*	*1992*	*1993*	*Total*
Eastern	31	22	11	11	22	13	28	14	7	7	1	167
Southern	12	27	14	7	37	9	24	15	20	17	1	183
Southwestern	7	11	3	4	11	6	27	5	7	3	6	90
Shannon	8	32	5	28	27	14	17	7	14	13	5	170
Western	6	2	1	2	4	0	3	3	4	3	1	29
Northwestern	6	2	0	0	2	5	4	2	0	1	3	25
Northern	15	13	7	14	19	4	8	6	8	7	16	118
	85	110	41	66	122	50	111	52	60	51	33	782